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NPIC/P&DS-3/65  
6 January 1965

DEFINITION OF P.I. PERFORMANCE STUDY # 2

In attempting to define the next short-term, accelerated study which is to be performed by [ ] under the existing contract on P. I. performance studies, P&DS and DD/S&T jointly derived some parameters which specifically apply to the method of investigation used in the preliminary study of "Performance as a Function of Resolution." The objective of the next study is to determine optimum stereo convergence and related obliquity angles for P.I.'s performing a representative image recognition task.

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It has recently been decided by the P&DS, who is funding the studies, that -- on the basis of the results of the first study in combination with the March deadline set for the subsequent study -- a less encumbered, more manageable approach should be used for the current problem. The first study has merit in its own right, but its shortcomings indicate that it needed the benefit of more time, and constant, clear, and unharried prosecution.

Moreover, we are indebted to make the best and most economical use of the P.I. time which has so generously been offered for our testing programs.

At a meeting on 9 January, which is to be attended by DD/S&T and P&DS contingents, the contractors will be asked to suggest a course which they feel they can manage in the time allotted.

The parameters which were originally set for the second study are still somewhat applicable and are included here for reference and to prompt additional thoughts for the 9 January discussions. All comments relate specifically to the experimental design of study #1.

Declass Review by NGA.

GROUP 1  
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I We are again interested in approximating that kind of task which requires identification of specific features within a target-type. As before, half of the participants will be selected from DIA and half from CIA components. The sample should be moderate in size so as not to misuse existing cooperation of the operational photo interpreters. These people should represent the best level of effort and specialization NPIC is capable of providing for a given target-type. Consequently, the selection of participants should this time be more thoroughly worked out in advance of the testing. In addition, non-P.I.s should be considered for participants for the sake of an interesting gauge on the tests.

II It is recommended that photography be collected over the southwest U. S., over a populous area containing approximately four target-types of interest for testing. The final decision on the area and the flight paths should be made by the contractors since, by this decision, they will be designating the subject matter for the test questions. We express confidence in the contractor's knowledge of the variables and their intimacy with the in-house operations and therefore expect them to assume the responsibility for those details and decisions which affect experimental design of the test.

Houston, Texas, (or Texas City-Calveston) is suggested as an area containing a variety of targets-of-interest.

1. Industrial -- refineries, chemical plants, steel mill, rubber plant, POL terminal, oil fields.
2. Transportation -- numerous highway and train bridges of various capacities; railroad, marshalling, and freight yards; commercial airports; shipping and ship channel; port facilities.
3. Military -- Ellington AFB, SAGE Combat and Direction Center, POL storage, NASA Space Center.
4. Power Plants and dam.

III The degraded materials should simulate a satellite photographic system having the following characteristics:

1. altitude --
2. focal length -- 60"
3. ground resolution --
4. contrast -- 2:1

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IV For all intents and purposes sun altitude and azimuth angles should remain constant. Sun altitude should provide minor shadow effect but should not create "dead" shadows which obscure large areas. (An angle which falls in the range of  $60^{\circ}$  to  $80^{\circ}$  would be suitable.)

V Because of obvious time limitations, an upper and lower limit is to be set on the range of possible stereo convergence angles which could be tested. The upper limit of useable stereo is believed to have been determined and to be physiologically limited to some convergence angle near  $30^{\circ}$ . This limit can be further specified and corroborated by means of a literature search which  will be requested to perform.

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Mensuration capabilities will set the lower limit beyond which accuracy of measurement falls off rapidly. A consultant to NPIC was requested to determine this lower limit(s) -- particularly for obliquity angles between  $30^{\circ}$  and  $60^{\circ}$ . His work indicates that for measuring stereo heights a critical drop-off in precision occurs below  $20^{\circ}$  of stereo convergence angle (for all obliquities) and at  $15^{\circ}$  that drop-off becomes severe. It would appear that convergences below  $20^{\circ}$  are just not in the running. Graphwork also indicates that as angle of convergence increases, accuracy increases until it becomes asymptotic at  $30^{\circ}$ . The smaller the angle of obliquity, the greater the accuracy, though the difference for convergences between  $20^{\circ}$  and  $30^{\circ}$  is in terms of 6" to 10" of measuring precision.

Three convergence angles equally divided between the upper and lower limits of the assigned stereo range are designated:  $10^{\circ}$  -  $20^{\circ}$  -  $30^{\circ}$ . These angles are to be examined in terms of: 1.) their effect alone upon P.I. performance, and 2.) their effect in combination with the below specified obliquities upon P.I. performance.

VI Obliquities are a "bonus" effect and will always be desired for the added information they can provide for many kinds of targets. Since their effect on optimum stereo convergence angle for interpretation purposes has not yet been established, the study should include three obliquity angles for each stereo convergence which is to be examined. The study should take into consideration obliquity angles within the range recognized by P.I.s as yielding the most valuable "extra" intelligence: i.e., angles of  $30^{\circ}$ ,  $45^{\circ}$  and  $60^{\circ}$ . Using these values as a basis, we hope to set a maximum scan angle which could be suggested for new systems.

Obliquity will also be investigated as an individual factor and in light of its effect upon the selected convergence angles and resulting P.I. performance.

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VII This paper suggests a general approach to the testing which is, of course, subject to revision by the contractors designing the experiment.

It is felt that a closer approximation of the actual conditions under which a PI performs (and is motivated) can be attained by submitting the selected GEMS and accompanying questions into the requirements system as regular PI assignments. These tasks should be limited to specific questions derived with the help of the requirements people and similar to those used in Task I, test #2. Through close cooperation of [redacted], it would be possible to present these tasks to the PI's, through their Branch Chiefs, as domestic coverage whose quality of readout has importance for the evaluation of new systems. Perhaps there could be four separate tasks -- one for each selected target type (or site) -- and each task could be assigned to three or four different people, working individually or in pairs, who are considered the best for their assigned target-type. This selection could also include individuals who are considered well-qualified, experienced PI's but who have a more general orientation. We need to consider the effects of stereo convergence and related obliquity angle in light of the optimum readout which NPIC can produce for a given resolution. Thus, we are primarily interested in refined intelligence not immediate readout.

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Search situations would not be part of the problem, since, with current equipment, stereo is infrequently used for scanning.

The participating PI's could be instructed to use only the collateral information provided (them) with the questions -- for the reason that the amount and kind of collateral would be similar to what is available on a comparative USSR target. With four relevant target-types, each of which would be considered only in part, we would have a chance to select domestic targets which: 1) because they are dissimilar to equivalent Soviet Bloc targets, could be treated as totally "new" targets which have just been detected (i.e., missile-associated activities); or 2) because they are similar in recognition characteristics and basic features to Soviet targets, could be treated as existing targets.

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[redacted]  
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